REMARKS

The application has been amended. Specifically, the limitation which previously appeared in dependent claim 41 has now been added to claim 22 and claim 41 has been cancelled. Further, claim 22 has been amended to clarify that the stages of the device are disposed inline relative to one another. Support for each of these amendments can be found throughout the specification and drawings as originally filed, such as on page 9 and in Figure 1, respectively. Thus, no new matter has been added and claims 22-40 are currently pending.

In the Final Office Action of February 27, 2008, claims 22-32 and 35-40 were rejected under 35 U.S.C. § 103(a) for obviousness over Abe (EP 0 913 357) in view of DeBellis et al. (US 2003/0044331). Additionally, claims 33 and 34 were rejected under 35 U.S.C. § 103(a) for obviousness over Abe and DeBellis in further view of Numata et al. (US 2002/0000067). Finally, claim 41 was rejected under 35 U.S.C. § 103(a) for obviousness over Gao (US 2002/0132147). In light of the foregoing amendments and following remarks, Applicants believe the claims are patentable over the cited documents and in condition for allowance.

The current invention is directed to a device for generating hydrogen comprising a heated steam reformation stage with a reformer catalyst for converting gaseous or vaporizable hydrocarbons and water into hydrogen, carbon monoxide, and other reformation products. The steam reformation stage is embodied as a hollow body with a shell chamber. The shell chamber is embodied as an annular chamber which can house a reformer catalyst. A heating device is arranged in the shell chamber. The device further contains at least one stage downstream of the reformation stage for catalytic conversion of the mixture emanating from the reformation stage. These conversion stages are embodied as a hollow body with an annular chamber that can house a catalyst. The current invention also contains a purification stage that is downstream of the conversion stage(s). The purification stage is for catalytic reduction of the residual carbon monoxide and is embodied as a hollow body with an annular chamber for housing a catalyst. The annular chamber of the purification stage directly connects with the annular chamber of the conversion stage and the annular chamber of the conversion stage directly connects to the annular chamber of the reformation

stage so as to form a complete, annular chamber that runs throughout the device with the stages disposed inline with respect to one another. Further, the device contains no separate feed lines, discharge lines, or bypass devices between the individual stages.

Abe is directed to a reformer device. The device includes a heating unit and several catalytic units arranged in series. The catalytic units are capable of generating hydrogen from a reactant which contains organic compounds. The catalysts include a catalyst for steam reforming reaction, a catalyst for CO shift reaction, and a catalyst for CO selective oxidation reaction. The heating unit and the catalysts are disposed in a metallic casing, which is generally a hollow tube. The reactant is fed into and flows throughout the entire cross section of the tube before exiting at the opposite end of the tube. Abe fails to teach, suggest, or disclose a series of catalytic stages where the catalysts are housed in annular chambers.

DeBellis is directed to an annular heat-exchange reactor vessel that allows for the controlled heat transfer between two fluids flowing through the vessel. The reactor vessel of DeBellis includes a central, hollow tube and two multi-channeled annular flow regions around the central tube. A plurality of fins extent throughout the annular flow regions. These fins are optionally coated with catalyst materials that promote combustion reactions. The heat from the combustion reactions, which occur within the annular space, is transferred via the fins to a fluid flowing within the central tube. This process heats the fluid within the central tube. DeBellis does not disclose the particular series of reactions recited by Applicants or disclose the use of a heating device. In fact, DeBellis teaches away from the inclusion of a heating device because the heating in DeBellis is done solely through the heat transferred from the combustion reactions within the annular chambers. In addition, as seen most clearly in Figure 7, when the vessel (100) is to be used in a system with additional stages, the resulting system includes a multitude of bypass and feeds lines between the individual stages of the device. (DeBellis at paragraph 70; Fig. 7).

Gao is directed to a method and apparatus for processing a hydrocarbon fuel. The apparatus includes at least two substantially separate reaction chambers that are in fluid connection with one another and disposed within an annular cylindrical reactor tube. As seen in Figs. 1-3, the individual reactor chambers are radially disposed around the interior reactor tube (40) so that the reformate gas exits a first reaction chamber through an opening (80) in

the top of the chamber and then flows in the opposite direction through a second reaction chamber. (Gao at paragraph 32). In this respect, the reaction chambers in Gao are not arranged "inline" of one another but rather are disposed in the parallel, radial arrangement described therein. In operation, Gao's radially disposed reaction chamber arrangement causes the burner element (10) to influence each of the stages of the reactor equally, since the distance between the burner (10) and each reactor chamber is essentially the same. Thus, Gao's apparatus would not be suitable for housing a multistage reaction where certain of the downstream reactions require cooling as opposed to heating, such as the reaction contemplated by Applicants where "[i]t is essential that a sufficient heat discharge is ensured from the exterior circumference of the catalyst stage 2." (Bottom of page 15 through top of page 16 of application as filed).

Applicants do not believe that the cited art, whether alone or in combination, teach or render obvious the invention recited in claims 22-40, as amended. The previous rejection of claim 41 under 35 U.S.C. § 103(a) was based solely on Gao. (February 27, 2008 Office Action, pages 10-11). The limitation of claim 41 has now been incorporated into claim 22 along with an amendment to define that the reaction stages are disposed "inline" with respect to one another, a feature clearly not taught or suggested in Gao. Furthermore, as mentioned above, Abe does not disclose annular flow chambers and DeBellis, while disclosing annular chambers, does not discuss the reaction stages in series in conjunction with a heating device. In addition, Figure 7 of DeBellis clearly shows that DeBellis's device, when used in a multistage operation, includes multiple inlet and outlet streams disposed between the stages.

Numata, which was previously discussed in connection with the rejection of claims 33 and 34, is cited only as allegedly teaching that one skilled in the art would find it obvious to equip a SelOx stage with an air supply and that this air supply could be embodied as an annular manifold with distributed discharge nozzles. However, Numata does not teach an annular chamber design, much less the use of such a design in conjunction with a separate heating device, or an inline reactor system where there are no separate feed lines, discharge lines, or bypass devices between the individual stage, and thus does not cure the deficiencies of Abe, DeBellis and Gao previously discussed.

For all of the foregoing reasons, Applicants submit that pending claims 22-40 are patentable over the cited documents and are in condition for allowance. Accordingly, a Notice of Allowance for each of pending claims 22-40 is respectfully requested.

Respectfully submitted,

THE WEBB LAW FIRM

By _____

Bryan P. Clark
Registration No. 60,465
Attorney for Applicants
436 Seventh Avenue
700 Koppers Building
Pittsburgh, PA 15219
Telephone: (412) 471-8815
Facsimile: (412) 471-4094
E-mail: webblaw@webblaw.com